About Redis:

Redis is an open source (BSD licensed), in-memory data structure store, used as a database, cache and message broker. It supports data structures such as strings, hashes, lists, sets, sorted sets with range queries, bitmaps, etc.

Functionalities which I used during implementation of Redis:

- Programming language: Java.

  Q. Why Java?

  Java is a widely used programming language in industries and it contains great support of different data-structures and their implementation.I have made some basic projects in this language and was eager to implement this application as it contains multithreading concepts ,different data structures and persisting data and using them,Jackson and many more project design concepts.

  Q. What are the improvements that can be made and how?

  I am currently using new threads for SET & EXPIRE commands but I can make seperate threads for persisting data and retrieving them.

  Problem:Update in ZADD is not allowed and time complexity of ZRANK and ZRANGE is o(n).

  Solution:Adding a hashmap between member and score will solve the update ZADD operation.Implementing sortedSet functions with skip-list or balanced binary search tree.If i use balanced binary search tree then it will take o(log(n)) for searching and its rank is number of elements in left subtree+1 and ZRANGE fetching node will take o(log(n)) and getting nodes of its right subtree will take o(m).If i use skip-list then same way i can fulfill this time complexity constraints.

  Problem: In the current implementation of EXPIRE and SET(with EX) after hitting the 1st command if i again hit the command with different expire time then the thread which gets 1st chance to execute will execute.Ideally it should be the last command's time.

  Solution: For solving this i can use some kind of mapping between key and Threads and if new Request comes i will kill the current thread and run new thread.

  Q. What data structures are used and why?

  I am using HashMap,SortedSet.The main reason of using Hashmap is Hashmaps has insertions,lookup and removal time complexity as o(1) and SortedSet(TreeSet) makes entities sorted so getting rank and range of elements can be done optimally.

  I have used HashMap for normal GET,SET,EXPIRE operations Hence i am able to keep o(1) time complexity for them.

  I have used SortedSet(TreeSet) and Hashmap for ZADD,ZRANK,ZRANGE functions where in Hashmap storing Key and sortedSet as Value.

Q. Does this implementation support multi-thread operations?

Yes,because for SET(with EX) & EXPIRE commands if we use a single thread then we need to wait for that millisecond for the system to respond, as for that milliseconds main thread sleeps. But this is not a practical scenario.Hence I am creating a seperate thread for executing the EXPIRE commands.

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